

ATTACHMENT 5

INITIAL INVESTIGATION

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**FACT FINDING INVESTIGATION
CONCERNING LOW POTASSIUM
ACTIVITY CONCENTRATIONS FOUND
IN SOIL SAMPLES FROM WITHIN THE
BUILDING 517 AREA**

Investigation Team

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ISSUE

On Thursday 10/4/2012, during a routine call with the Radiological Affairs Support Office (RASO), it was suggested that the final systematic samples collected for Survey Unit 2 (within the B-517 footprint) had been collected from locations different than what was specified in the Final Status Survey Unit Report issued. Low potassium-40 (K-40) sample activity (< 5 picocuries per gram [pCi/g]) coupled with low radium-226 (Ra-226), bismuth-214 (Bi-214), and lead-214 (Pb-214) reported by the on-site DoD accredited laboratory was the reported cause for this allegation.

INVESTIGATION

Investigation concerning this allegation started on Friday, 10/5/2012. Building 517 Survey Unit 2 (B-517/SU-002) was located and marked out by TtEC on-site engineers. Final systematic sample locations and building footprints (B-509/B-517) were also located and marked. Once all markings were completed, stakes and rope were erected to establish a perimeter around SU-002. Signs reading “Do Not Enter” were hung around the perimeter to negate foot and equipment traffic.

On Monday, 10/8/2012, potholes were excavated at sample locations #141, #148, #149, and #155 to identify geological material type. Excavation at each location was performed in 6-inch lifts, with photos and measurements being taken between lifts. A geologist was present to aid in the identification of subgrade material types.

In tandem with securing the B-517/SU-002 area on 10/5/2012, all archived samples taken from the survey unit were pulled aside and secured for comparison with the findings from the potholing evolution. Photos of systematic samples from locations #141, #148, #149, and #155 were collected.

On 10/8/2012–10/9/2012 interviews were initiated with the staff associated with the sample collection at B-517/SU-002.

FINDINGS

Interview Findings

The Project Quality Control Manager (PCQM) supported the Radiation Safety Officer Representative in a fact finding investigation regarding the final systematic sampling of B-517/SU-002.

This sampling activity was performed on Tuesday, 4/10/2012. Thirty-six samples were collected. The Radiological Control Technician (RCT) began sampling about 11:15 hours; this sampling evolution was completed after 15:00 hours. The following personnel (some are not available—there is a current reduction in force) were interviewed by telephone and their answers are documented below.

The Building Radiological Supervisor: This is the supervisor who oversaw the final systematic sampling in SU-002. He was off-site during the interview and pulled over on the side of the road in Pennsylvania to talk. He recalled the sample locations having “hard ground” in this area. He recalled the craft foreman using a chipping hammer/Hilti gun (roto-hammer) to break up the material at the sample points to obtain the samples. He recalled serpentine rock to be prevalent throughout Survey Unit 2, as well as the surrounding area. He recalled the use of a backhoe during earlier sampling evolutions because the surface was so hard—holes dug in this fashion may have been 8–9 inches or a little deeper. He recalled no cesium in this area. He recalled a brown material used for fill being found in this area.

The RCT: This is the RCT who pulled the samples. He recalled craft support during sample evolutions, where the craft used the Hilti gun (roto-hammer) to break up the sample locations. He recalled use of heavy equipment to obtain sample material, prior to the craft using power and hand tools. He recalled it was a thin bucket, about 2 feet in depth, on the equipment. Sample points were dug down about the depth of the bucket. He recalled that samples were taken from the bottom of the hole. He recalled frequently finding “a yellow cake-like” material around the Building 517 area.

The Craft Foreman: This is the foreman who supported the sampling crew during sample evolutions. He recalled “they would take turns” on a Hilti (roto-hammer) with a laborer, switching off breaking up the ground and shoveling out material. He recalled prior to using the Hilti, they would use a pick axe to break up the ground for sampling in this area. He recalled the serpentine rock making digging difficult in the Building 517 survey units and the surrounding area. He noted they would collect sample material in a consistent method for an entire sample evolution.

The Professional Field Engineer: This engineer laid out the sample points. He and his co-engineer both verified that serpentine rock was prevalent on the surface and in the subgrade of SU-002 and the surrounding area. He recalls sample points in this location excavated to a depth of about 18 inches when a backhoe was used. Both engineers recall a serpentine stratum (layer of fill) in Trench Unit 305, which borders the west side of SU-002 and enters the north end—they supplied a photo (see Figure 1) and map (see Figure 2).



Figure 1. Trench Unit 305 running along the northwest border of Survey Unit 2. Serpentinite boulders shown.

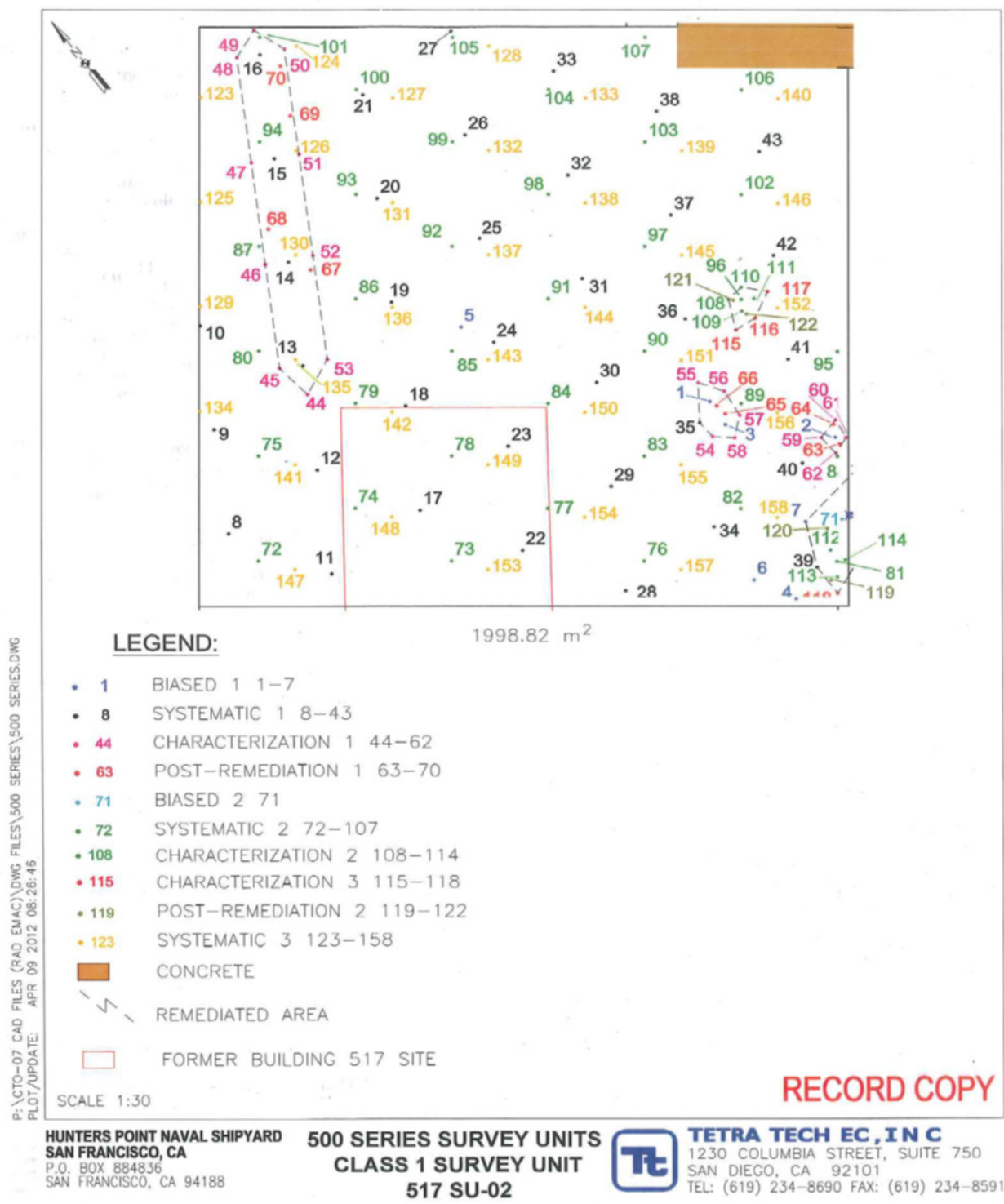


Figure 2. Map showing Trench Unit 305 running along the northwest border of Survey Unit 2.

The PQCM: Brought a fox tail brush to Survey Unit 2 and brushed off a few of the existing sample locations (many original locations had been tracked over by heavy equipment) to expose what was under the dust. The existing sample points looked like 2-foot-diameter bowls in the ground with spoils on the side as shown in Figures 3, 4, 5, 6, and 7.



Figure 3. Sample location #128 from SU-002 after brushing.



Figure 4. Sample location #140 from SU-002 after brushing.



Figure 5. Sample location #145 from SU-002 after brushing.



Figure 6. Sample location #146 from SU-002 after brushing.



Figure 7. Sample location #147 from SU-002 after brushing.

The Assistant Project Manager: He is a registered professional geologist. He verified the rock, which the interviewees and the investigators have been referring to, as well as Franciscan Formation.

Geological Findings

Parcel E is bounded on its north side by a bedrock ridge composed of a dark gray to greenish gray shale matrix mélange and dark greenish black serpentinite of the Franciscan Formation, and is bounded on the south by the San Francisco Bay. The Franciscan Formation consists of a variety of rock types, including basalts, cherts, sandstones, siltstones, shales, and serpentinite. It should also be noted that serpentinite is formed by the cooking and squeezing (metamorphic processes) of mafic to ultramafic rocks. The resulting rock is commonly high in iron and magnesium and low in potassium and calcium.



Figure 8. U.S. Naval Photo, 1942, showing hillside and underwater geological formation.

In the late 1930s and early 1940s fill was used to create the Parcel E land surface beyond the historic shoreline at HPNS (Figure 8). This fill ranged from silty and sandy clays with gravel to poorly graded sands, boulders, and debris deposits. A majority of the coarse fill material was locally derived from the Franciscan Formation bedrock consisting of serpentinite, greenstone, shale, greywacke, and chert. In addition, during the creation of Parcel E by filling in South Basin, the island of Shag Rock was incorporated into HPNS (Figure 9). This remnant island also is made of up Franciscan Formation material.

The bedrock or bedrock material used as fill material encountered within Parcel E consists mostly of metamorphic basalt called “greenstone” and serpentinite. Competency of the bedrock material at Parcel E ranges from low to very hard, and fractures are common. The weathered material has low hardness, crumbles easily to sand-sized grains, and is friable. The unweathered serpentinite is hard and fractured (Figure 10).

During the pothole study at locations #141, #148, #149, and #155 within B-517/SU-002, various colors of native soil and backfill were observed that are consistent with subsurface soils typically encountered at Parcel E. The test pits were dug to a depth of 3 feet below ground surface and the material encountered was consistent with materials derived from the Franciscan Formation: weathered to unweathered serpentinite and greenstone in a clay/silt matrix mixed with a variety of sandstone and siltstone fragments. This is what would be expected either from the use of bedrock material as fill material or due to excavation in the proximity of the Shag Rock Island bedrock fragment.



**Figure 9. Nautical Map, 1907, showing Shag Rock location and depth in feet (MSL).
As shown, buM represents blue mud as referenced from this map's key.**



Figure 10. Serpentine slope at HPNS. Plant varieties are quite limited.

General Findings

Radiation Safety Officer (statement): “It appears from circumstantial sample result evidence that a different sampling methodology was used for the third set of 36 final systematic samples as compared to the previous sets of final systematic samples and characterization and post remediation samples. This is based on the fact that the third set of final systematic samples contained all 36 samples with a significantly lower potassium-40 and Ra-226 and daughter products concentrations than any other samples taken within the survey unit, including surface samples, and samples expected to be collected at lower depths (i.e., post remediation samples in the survey unit.) (See figure 2 to see the sample locations). Analysis of the 500 Series Survey Unit 3 (which is adjacent to the Building 517 survey unit 2) sample results show that all of the post remediation sample results (which are collected at a deeper depth) match the radiation

signature of the third set of final systematic samples from Building 517 survey unit 2 (i.e., an extremely low potassium-40 and Ra-226 series concentration.) (See attachments 1 and 2.) A plausible theory is that the samples from both of these survey units were taken from the same strata of material, which is likely serpentinite. Because the samples in the 500 series survey unit 3 were taken at depth (possibly 2 to 3 feet below the surface), one could expect that the Building 517 survey unit final systematic samples were collected at the same depth (assuming the terrain in the area is flat, and the strata of assumed serpentinite is flat.)

It is further believed that a significant number of HPNS staff is aware that serpentinite has low concentrations of Ra-226, and that soil below 6 inches is not likely to contain Cs-137. The potential exists that as this was the third set of systematic samples collected in a survey unit that serpentinite may have been collected for the sample either by willfully digging deeper until seeing the physical characteristics of the soil type, or by segregating the soil type from the soil removed if removed by mechanical means, in an attempt to ensure that the set of systematics passed. If this was, in fact, the case, any members involved in the sampling evolution will be reticent to come forth with details for fear of self-incrimination, or incriminating others.”

Excavation/Pothole Findings

Potholes were excavated at sample locations #141, #148, #149, and #155 with heavy equipment to identify geological material type and depth. Excavation at each location was performed in 6-inch lifts, with photos and measurements being taken between lifts (See Figures 11 through 29). A geologist was present to aid in the identification of subgrade material types.



Figure 11. Sample location 141 at grade.



Figure 12. Sample location 141 at 1'.



Figure 13. Sample location 141 at 2'.



Figure 14. Sample location 141 at 3'.



Figure 15. Sample location 148.



Figure 16. Sample location 148 at 1'.



Figure 17. Sample location 148 at 2'.



Figure 18. Sample location 148 at 3'.



Figure 19. Sample location 149.



Figure 20. Sample location 149 at 1'.



Figure 21. Sample location 149 at 2'.



Figure 22. Sample location 149 at 3'.



Figure 23. Sample location 149 bottom of hole.



Figure 24. Sample location 149 cobbles found.



Figure 25. Sample location 155.



Figure 26. Sample location 155 at 1.5'.



Figure 27. Sample location 155 at 2'.



Figure 28. Sample location 155 at 3'.



Figure 29. Sample location 155 serpentinite lens shown.

Archived Sample Findings

Left over sample media from locations #141, #148, #149, and #155 (the same locations where investigative potholes were excavated) were photographed. See Figures 30, 31, and 32.



Figure 30. Sample #07517-S0002-F141-01.



Figure 31. Sample #07517-S0002-F148-01.

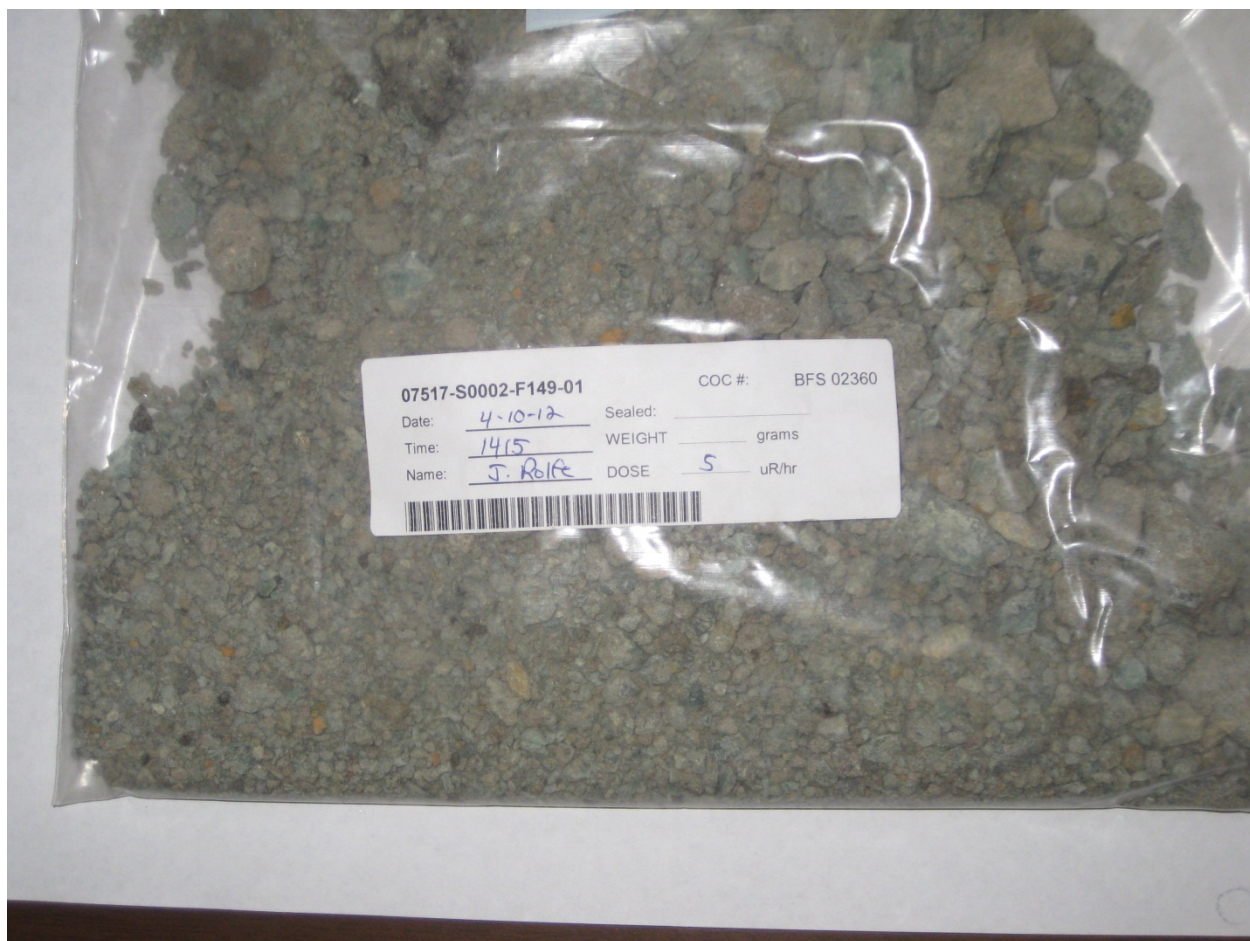


Figure 32. Sample #07517-S0002-F149-01.



Figure 33. Sample #07517-S0002-F155-01.

CONCLUSION

From statements of individuals involved with sampling, different sample collection techniques were employed, including use of excavators, Hilti guns, and pick axes. Evidence exists of soil exhibiting the same characteristics (low K-40 and Ra-226 series radionuclide concentrations) as those found in the third set of final systematic samples collected in Building 517 Survey Unit 2 in an adjacent survey unit. Geological history of the site supports the existence of serpentinite soil with those radiological characteristics. The depth at which the final systematic samples were collected is inconclusive, which means that the samples may not be characteristic of the top 6 inches of soil in the Building 517 Survey Unit 2.

RECOMMENDATIONS

1. While investigating this allegation, the Sampling and Analysis Plan was referenced, which stated to use the project specific standard operating procedure (SOP). SOP HPO-Tt-009 was referenced and found to inadequately address some subjects.
 - a. SOP HPO-Tt-009 addresses soil and solid sampling as if they are the same process. Collecting a soil sample from current grade to 15 centimeters can usually be performed with hand tools. When sampling in a rocky media with

heavy equipment, one large stone or cobble extracted can easily consume more than 15 centimeters in depth, therefore breaching the maximum 15 centimeters below grade standard. This should be addressed by means of an SOP change either allowing for sampling at a deeper depth, or expanding the radius of the sample collection area.

- b. SOP HPO-Tt-009 addresses sample packaging and transport and gives reference to a type of Chain of Custody (COC) that is no longer used by TtEC at HPNS. The currently used COC should be referenced and shown as an attachment.
2. Current sampling staff should be retrained on the revised SOP HPO-Tt-009. Training should include a mock-up in field training session with a class roster being used as evidence of training.
3. TTEC should ensure that all employees who collect soil, solid, or sediment samples have a measuring device capable of reading 15 centimeters and beyond, i.e., a small pocket tape measure or ruler.
4. All HPNS staff should receive training of the ethical importance of collecting a representative sample from the top 15 centimeters (6 inches) of soil as this is the basis for dose and risk modeling that leads to the radiological free release of a survey unit.
5. Collect another round of 36 final systematic samples in Building 517 Survey Unit 2 using another Visual Sampling Plan map based on a triangular grid. The entire sample collection process including verification of depth of the samples should be physically monitored by a Quality Assurance member. These systematic sample results should be used in the Building 517 Final Status Survey Report.